

## TOPCON REAL-TIME KINEMATIC (RTK) + POST-PROCESSING KINEMATIC (PPK) SURVEY NOTES



*Battery and solar-powered RTK base station with Topcon GB-1000 Receiver, PG-A1 GPS Antenna, and FC-100 Data Controller. Radio antenna (left of case) has not yet been mounted.*

### IMPORTANT NOTE:

To get the GB-1000 out of sleep mode (keys beep, but nothing shows on the display), press F-1+F-4 keys simultaneously until display comes on again.

Modifications from original UNAVCO document:

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Other manuals and software at:

[http://www.gps.alaska.edu/internal/index.php/Topcon\\_RTK](http://www.gps.alaska.edu/internal/index.php/Topcon_RTK)

user: gps, password: same as windows work station.

## BASE STATION SETUP

1. Set up the GPS antenna using a tripod or other antenna mount. Level the antenna and align to true north. See instructions later in this manual for tripod/tribrach setup. Measure and record the antenna height.
2. Connect the hardware as shown in the below diagrams. **Similar to our Setup. Should be wired.**
  - (a. Connect the positive and negative leads from the solar controller to the battery)
  - b. Connect the power cable from to the GB-1000 receiver
  - c. Connect the GPS antenna cable to the receiver
  - d. Connect the base radio to the power cable and to Port C of the GB-1000 receiver.  
**Always verify that the base radio is in lower power mode** (switch on back).
  - e. Connect the radio antenna cable to the base radio





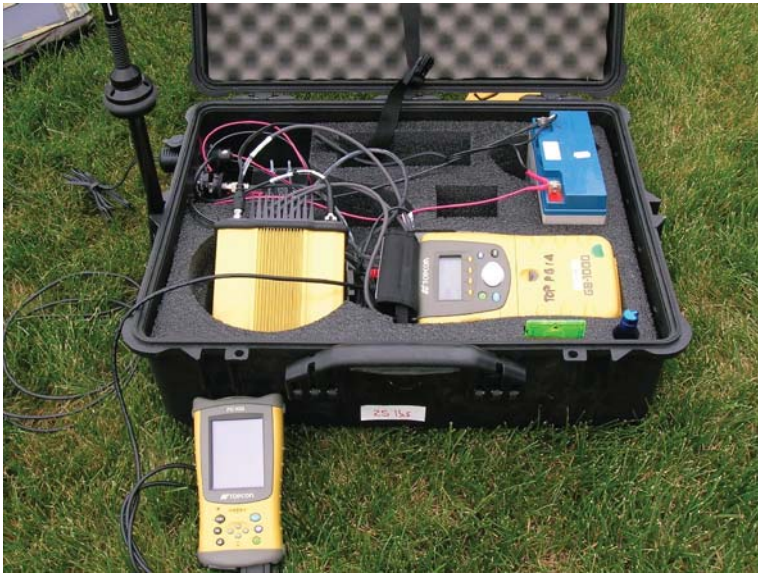


3. Assemble the base radio antenna (3 pieces). Mount the antenna onto a tripod there is no provided clamp as in the picture below.



4. Turn on the radio and set the channel to 0 (can be done in the software).

5. Connect the FC-250 Data Controller to port A of the receiver using the serial cable.



Turn on the Data Controller and open TopSurv by double-clicking the icon on the desktop  
*These instructions all refer to TopSurv v.5.11.01*

To start a new job

- Click 'New'

- Enter a survey name; click 'Next'

- Select 'GI RTK PP' as the survey configuration style; click 'Next'

- Select projection (choose 'none' for lat/long); click 'Next'

- Select units

- Click 'Finish' at the top of the screen to save changes or go to the end to set nasty alarms

From the main window, go to 'Setup GPS' and 'Start Base'

- Enter a point name, the antenna height + measuring type, and select 'Auto Pos' and wait about 20 min or edit coordinates

- Note that the base station coordinates will appear as decimal degrees, but the units are actually degrees-minutes-seconds, i.e. DD.MMSS. Hence 40.033820815° should be read 40° 03'38.20815".

- Click 'Start Base'

Your base station should now be running. You can disconnect the FC-250 from the receiver.

6. Verify that the base radio is transmitting data (TX/RX light flashes green). The rover radio should be turned off during this test. If the base radio is receiving data, you will need to select a different channel. To do this, see the troubleshooting guide at the end of this document.

## ROVER SETUP

1. Insert antenna mast into side pocket of backpack or assemble range pole. Attach GPS antenna to mast.
2. Assemble the rover radio (attach 3 pieces including radio). Little antenna tip is in one of the side pockets. Connect the radio to port C of the receiver. Turn on the radio, and set it to the same channel as the base radio (should be 0). Turn on the receiver and assemble equipment inside backpack.
3. Connect the GPS antenna to antenna cable.



4. Connect the FC-250 Data Controller to serial cable (port A of receiver)
5. Turn on the Data Controller and open TopSurv  
Open the job created during base station setup  
From the main menu, go to 'Setup GPS', 'Status'  
From the 'Pos' tab, the horizontal (H) and vertical (V) precision, number of satellites, and position type are displayed  
From the 'Sys' tab, check the parameters for  
Position type – Auto, Float, or Fix  
Number of satellites in common with the base station – 4 minimum  
Radio link ~ 100%. If there is no radio link, then you are not using RTK and the real-time position type will be autonomous.  
**If the radio link is not established after a few minutes**  
Click the drop-down menu in the upper left corner  
Select 'Reset RTK'  
The radio link should now show 100%  
For highest RTK precision, the positioning type should be 'Fix'  
Autonomous ~10 m precision  
Float ~1 m precision  
Fix ~1 cm precision
6. To measure a point or to set up continuous point mapping  
From TopSurv on the FC-250 Data Controller  
Go to 'Survey' and 'Topo' or 'Auto Topo' respectively  
The status line (upper screen edge) indicates the radio link %, the position type, the horizontal (H) and vertical (V) precision, and the number of satellites being tracked. To store RTK points, the position type must be 'Fix'. PPK points will be stored regardless of the position type.  
Enter the point name or leave as default, select the antenna height and measurement type (slant or vertical)

Press 'Settings' at the top of the screen to change survey parameters. For a simultaneous PPK and RTK survey, you can do continuous mapping only by time, not distance.

For Topo (stop-and-go kinematic surveying)

Press 'Start Log' to begin survey

You'll notice that the 'Remaining Time' field counts down. This is the initialization time. Do not stop the survey until it reaches 0.

Press 'Start' to take a point observation. The observation lasts for the number of epochs specified in the survey settings (e.g. 3).

Press 'Accept' to override the epoch count (not recommended)

To stop the survey, press 'Stop Log'

For Auto Topo (continuous kinematic surveying)

Press 'Start Log' and 'Start' and begin moving

You'll notice that the 'Remaining Time' field counts down. This is the initialization time. Do not stop the survey until it reaches 0.

To pause the survey, press 'Pause'

To override the interval survey parameter temporarily and log the current location, press 'Log Now'

If the Auto Topo track is not visible in map view, click the properties (right-most) icon and check 'Auto Topo'

To stop the survey, press 'Stop' and 'Stop Log'

7. To locate a point in the database

From TopSURV on the FC-250 Data Controller

Go to 'Stake' and 'Points'

Use the map or list icon beneath the 'Design Point' field to select the point

Select 'Stake' and navigate to the point

## TROUBLESHOOTING

1. To change the radio channel if 0 is in use

Press the channel button on the base radio to select a different channel. In TopSurv on the Data Controller, go to 'Config' => 'Survey', and click the '...' next to 'GI RTK PP'. Select

'Edit' and navigate to the TRL-35 radio modem menu. Enter the new channel. Verify that the rover radio is on the same channel as the base (select using button on modem).

2. If there's a break-down in communication between the receivers, radios, and/or Data Controller

From TopSurv on the FC-250 Data Controller

Go to 'Setup GPS' and 'Status'; select the 'Sys' tab

Click the drop-down menu in the upper left corner

Select 'Reset RTK'

If there is still no radio link, try the following:

On the Topcon GB-1000 front panel

From menu 'Port Setting' select Serial Port A

Verify the baudrate is set to 115200, format is 8-N-1, and flow control is Off

Press ESC (escape) and do the same for Serial Port B

Press ESC (escape) and select Serial Port C

Verify the baudrate is set to 38400, format is 8-N-1, and flow control is Off

Press the menu key or ESC to return to the main menu \

OR: try 'Config Radio' for both base and rover (attach FC-250 first to base, then to rover to make those changes).

3. To change the base radio output power:

Go to 'Setup GPS' => 'Status'; select 'sys' tab

'get f req list', change output power to desired value from drop down menu, set, wait, done.



## DATA DOWNLOAD

1. To review available files from the Topcon GB-1000 receiver front panel  
From the main menu, go to 'File Information'  
Highlight 'Internal Memory' and press enter (ENT) to review data files
2. Data download using PC-CDU (for data on internal memory only)  
If you do not have PC-CDU installed on your computer, do so now. On the 'Topcon GPS Software' CD, navigate to the folder PC-CDU Lite\PC-CDU\Installer. Copy and paste PC-CDU onto your computer. PC-CDU is also available on the web at <http://www.topconpositioning.com> (Go to Products → Software → GPS)  
Connect the computer to Port B of the Topcon GB-1000 receiver using the serial cable, or connect using the Ethernet cable.  
Open PCCDU.exe  
Select the appropriate port (COM1, COM3, ETHR, etc). For a serial connection (COM), select baud rate 115200. For an Ethernet (ETHR) connection, you will have to supply the receiver's IP address (192.168.1.2) and the password (TOPCON).  
Click 'Connect'  
Go to File → File Manager  
Go to the 'Download path' tab to select the destination of the downloaded files  
Go to the 'Download files' tab, highlight the files you want to download (hold down the shift key to select multiple files), and click 'Download'. You can also delete files from this menu by selecting files and clicking 'Delete.'  
When finished, select 'Exit'  
Go to File → Disconnect  
Repeat process for additional receivers

See instructions later in this manual for other downloading methods, including ftp.

## DATA PROCESSING using Topcon Tools v.5.11.01

### For First-Time Users

1. Install Microsoft ActiveSync on your computer by going to <http://www.microsoft.com/windowsmobile/downloads/activesync38.mspx>
2. Install Topcon Tools on your computer  
Insert the 'Topcon Tools' CD  
If the setup menu does not load automatically, open the file Topcon\_Tools\_ver\_511.exe  
Select Topcon Tools + Link Setup  
Follow the prompts to install the software

### Importing Data into Topcon Tools

1. Open Topcon Tools on your computer  
Make sure that the purple Topcon dongle is inserted in your USB port, otherwise you will only be able to use the demo version of Tools.  
Create a new job  
Enter a job name and select GPS+ Configuration  
From the main window, go to 'Job' and 'Import'  
Navigate to the directory where you downloaded the data files from the receivers  
Select the desired files and click 'Open'  
Points will be displayed in map view. Not all points will be displayed prior to processing.

## Before Processing

1. Go to Job → Job Configuration to edit settings  
Go to 'Process' and select the GPS+ PostProcess tab. If conducting a post-processing kinematic survey, **check 'enable continuous kinematic'**. Until you do this, most of your points will not appear. Here you can also select an elevation mask for processing.  
Go to 'Coordinate Systems' to select a projection ('None' for lat/long) and datum (e.g. WGS84).  
To change the coordinate display, i.e. decimal degrees or DMS, go to 'Display' and 'Angles'.
2. To customize the table in the lower window, e.g. to add a baseline length field to the 'GPS Obs' tab in the lower window  
Go to View → Tabular View Options  
Move 'Distance' from 'Available columns' to 'Selected columns'
3. Go to 'GPS Occupations' tab in the lower window to verify (and edit if need be) survey metadata such as antenna type and height, station names, etc.

## Data Processing

1. If you have a base or reference station with known coordinates, fix the station to generate a better solution  
For the reference station, in the 'Points' tab in the lower window  
Insert known coordinates into the Latitude and Longitude fields  
Change the value in the Control field from 'None' to 'Both'
2. To process data  
Go to Process → GPS+ PostProcessing  
(To process only certain baselines, highlight them in the map view, right-click, and select GPS+ PostProcessing)  
Go to the 'GPS Obs' tab to view point precisions
3. Perform Network Adjustment to minimize errors throughout network  
(This can only be done if you have a reference station with known coordinates)  
Go to Process → Adjustment  
Standard deviation now appears in the 'Points' tab
4. To see warnings about points and baselines  
Right-click on the point or baseline, which is generally red if there's a problem  
Select 'Properties' and go to 'Quality Control' tab  
Messages may indicate points that exceed the precision limits  
To change precision limits, go to Job → Job Configuration → Quality Control  
Messages may also indicate multiple points suspected of being the same (see below)
5. For multiple points suspected of being the same  
Go to COGO → Inverse to calculate distance between suspect sites  
To force observations to combine, simply change the Point Name of one in the 'GPS Occupations' tab in the lower window. Reprocess and re-adjust.  
Alternately, you can leave the observations as they are to analyze repeatability, or you can leave them uncombined and average later

## To Import RTK data

This is not necessary (or recommended) if you did a simultaneous post-processing kinematic survey. The PPK data (which by this point you should have already processed) is stored on the GB-1000 receiver; the RTK data is stored on the FC-100 Data Controller.



1. Connect the FC-100 Data Controller to the computer by the USB cable. When prompted on the computer by ActiveSync to set up a partnership, select no and click 'Next'. Minimize the ActiveSync window. You will not be able to import the TopSurv job unless ActiveSync is connected.
2. From within a job in Topcon Tools  
Go to 'Job' and 'Import from Device'  
Open 'Mobile Device' and navigate to CF Card → TPS TopSURV → Jobs  
Select the job that you created in TopSurv and click 'Open'  
Points will be displayed in map view  
Do NOT export data from TopSurv into a file and then import that file into Tools, as the coordinates will not be stored in the proper format!

### **Exporting Data**

1. From the main window, go to 'Job' and 'Export'  
Select the output file format, e.g. Name,Lat,Lon,Ht,Code (\*.csv), which can be opened in Microsoft Excel. Some of the other formats have formatting errors between decimal degrees and degrees-minutes-seconds (DMS), but .csv should be dependable.  
Select the file destination